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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/961,036	09/21/2001	Madhav Datta	884.523US1	4661

21186 7590 07/26/2005

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EXAMINER

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ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 07/26/2005

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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/961,036
Filing Date: September 21, 2001
Appellant(s): DATTA ET AL.

MAILED
JUL 26 2005
GROUP 2800

Ann M. McCrackin
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 18 May 2005 appealing from the Office action mailed 13 September 2004.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of the evidence (e.g., patents, publications, Official Notice, and admitted prior art) relied upon in the rejection of claims under appeal.

US 5,376,584	Agarwala	12-1994
US 6,348,730 B1	Yi et al.	2-2002

Microelectronics Packaging Handbook, Semiconductor Packaging, Part II, 2nd edition, Tummala, et al. eds., Kluwer Academic Publishers: Boston, 1997, pp. 132-139.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 17, 19, 21, 23, and 25 stand rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,376,584 (**Agarwala** et al.) in view of US 6,348,730 B1 (**Yi** et al.).

Agarwala discloses a process of forming a ball limiting metallurgy (BLM) comprising, forming a metallization (layer shown beneath that layer labeled “20” in Fig. 3, but not labeled, to which the BLM layers 22, 24, and 26 electrically connect; col. 4, lines 3-8; col. 1, lines 10-15);

forming phased metal layer 24 using physical vapor deposition, which comprises two metals including a first refractory metal of Cr, Ti, Zr, Mo, Ta or any other metal or alloy which will adhere to the surface of the metallization and a second refractory metal including Co, Ni, Pt, and Pd (paragraph bridging cols. 3-4); and

forming a conductive bump 28, Figs. 4-6 above the phased metal layer 24.

Agarwala does not indicate the nature of a phased metal layer, or more specifically that the phased metal layer includes a first and third layers of substantially the same metal and the second and fourth metals are of substantially the same metal.

Yi, like **Agarwala**, discloses a BLM and method of making, having a phased metal layer 53 (Yi, Figs. 8-9, plurality of 151 and 155) formed by physical vapor deposition (e.g. sputtering; col. 3, lines 39-44), wherein the first and third metals are the same (Cr in one example) and second and fourth metal layers are the same (Cu in one example). (See also Yi, col. 3, lines 7-14; col. 4, lines 32-49.)

It would have been obvious for one of ordinary skill in the art, at the time of the invention, to form the phased metal layer of **Agarwala** using the method of **Yi**, wherein the metal composition alternates between the different refractory metals indicated in **Agarwala** to be in the phased metal layer, in order to achieve the benefits indicated in **Yi**, such as achieving the desired thickness of the metal layers (col. 2, lines 59-63); and speeding up the process and reducing the cost of making the metal layers (col. 2, lines 64-67).

3. Claim 18 stands rejected under 35 U.S.C. 103(a) as being unpatentable over **Agarwala** in view of **Yi** as applied to claim 17 above, and further in view of Microelectronics Packaging Handbook, Semiconductor Packaging, Part II, 2nd edition, Tummala, et al. eds., Kluwer Academic Publishers: Boston, 1997, pp. 132-139 (**Handbook**, hereafter).

The prior art of **Agarwala** in view of **Yi**, as explained above, discloses each of the claimed features except for indicating that the metallization contains one of M1 to M6 connected to a copper bonding pad metallization.

The **Handbook** teaches that it is notoriously well known (1) for the bonding pad to be copper (p. 137, last paragraph, and Fig. 8-6 on p. 138), as well as (2) for the bond pad to attach to one of the metallization layers (the third metallization layer as shown in Fig. 8-2, on p. 133). It would have been obvious for one of ordinary skill in the art, at the time of the invention to ensure that the BLM of **Agarwala** connects to a copper bond pad because copper bond pads are notoriously well known in the art, as taught in the **Handbook**, and for the bond pad to connect to one of the metallization layers, in order to make an electrical connection to the devices in the semiconductor chip, as is essential for providing power, signal input/out, etcetera, as taught by the **Handbook**.

(10) Response to Argument

Appellant's indication of "The Applicable Law" on pages 8 and 9 of the Brief is noted. Examiner respectfully submits that the law has been properly followed in rejecting the claims. Appellant has not applied the case law to the rejection at hand; therefore, there is nothing further for Examiner to address in this regard.

Response to arguments under subheading entitled, "**Claims 17-19, 21, 23, and 25 are Patentable over the Cited References under 35 USC 103 because a Prima Facie Case of Obviousness has not been Established.**" (Emphasis in original.)

Examiner respectfully submits that a *prima facie* case of obviousness has been made, as clearly pointed out by the applied art used in the rejection of the claims. Applicant's argument are premised upon the incorrect notions that (1) because Yi uses copper with chromium metals in the phased metal layer, that one of ordinary skill would not use the refractory metals indicated in

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Agarwala to be in the phased metal layer of Agarwala; and that (2) Yi does not teach the first and third metals are the same and the second and fourth metal layers are the same. Examiner respectfully disagrees on both counts.

In regard to (1) Appellant correctly points out that Yi uses chromium (Cr) and copper (Cu) in the phased metal layer. Examiner agrees that copper is not a refractory metal. Applicant's argument is, however, irrelevant because Agarwala discloses a phased metal layer of **two refractory metals**, stating in the paragraph bridging cols. 3-4,

“Referring now to the drawings, and more particularly to FIG. 2, there is shown a supporting substrate **20** to which a semiconductor chip is to be electrically and mechanically connected by a solder joint. Three blanket layers, including a solder non-wettable adhesion layer **22**, **a phased layer 24**, and a solder wettable layer **26**, are sequentially deposited onto substrate surface **20**. Any number of well known deposition methods may be used to accomplish this, such as, for example, physical vapor deposition or sputtering. The non-wettable layer **22** may be, for example, **chromium (Cr), titanium (Ti), Zirconium (Zr), molybdenum (Mo), tantalum (Ta)**, or any other metal or alloy which will adhere to the surface of the supporting substrate **20** or semiconductor chip (not shown). The wettable layer **26** may be, for example, **copper (Cu), cobalt (Co), nickel (Ni), platinum (Pt), palladium (Pd)**, or any other metal or alloy which is wettable by molten solder. **Phased layer 24 is a transition layer between non-wettable layer 22 and wettable layer 26 and is comprised of a phased combination of the two metals making up the layers 22 and 26.**” (Emphasis added.)

Because all of the metals of non-wettable layer **22** are refractory and all of the metals of metal layer **26** (with the exception of copper) are refractory, Agarwala clearly discloses the use of **two refractory metals** in the phased metal layer **24**. While Agarwala, like Yi, discloses the specific example in Yi of a Cr-Cu phased metal layer, Agarwala, when combined with Yi is not limited to the example in Yi of Cr-Cu.

It is also noted with interest that Appellant in the instant specification discloses and claims as refractory, several of the same metals disclosed in Agarwala, specifically, Ni, Co, Pd, Pt, Ti, Cr, Mo, and Zr. (See instant claim 19.) Accordingly, Appellant's argument in this regard can be viewed, at best, as ignoring of, if not intentionally dismissive of, the fact that Agarwala discloses a phased metal layer **24** of **two refractory metals**. Yi was applied (1) to show that which one of ordinary skill knows a phased metal layer to be, and (2) to show an especially beneficial manner of making a phased metal layer since Agarwala does not go in to detail about either what a phased metal layer is or how it is manufactured, except to state that “[a]ny number of well known deposition methods may be used to accomplish this, such as, for example, physical vapor deposition or sputtering,” (See Agarwala excerpt, *supra*.)

Regarding (2) above, to restate, Appellant argues that Yi does not teach the first and third metals are the same and the second and fourth metal layers are the same. Appellant's argument is based upon the notion that because **51** and **151** are each Cr, that the first metal layer **51** and the second metal layer **151** are the same. Examiner respectfully disagrees.

The disagreement is firstly based upon the construction of claim 17. First, **nothing in claim 17 requires the first, second, third and fourth metal layers to even be different metals**. Rather the claim only requires the first and third layers to be the same and the second and fourth layers to be the same. Accordingly it is erroneous for Appellant to argue that layer **51** in Yi must be different from layer **151** in type of metal since claim 17 does not require this.

Second, assuming *arguendo*, that the first and second metal layers were required to be different metals, the language of claim 17 requires neither direct contact between the first layer and the underlying metallization nor direct contact between the second metal layer and the first

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metal layer. Rather, instant claim 17 states only “a refractory metal first layer **over** the metallization” and similarly, “a refractory metal second layer **over** the first layer.” And there exists nothing in the specification that defines “over” to mean “over and directly contacting.” Therefore there is no requirement for metal layer **51** of Yi to be interpreted as the “first metal layer,” in the context of claim 17. Any metal layer **over** the metallization of the semiconductor chip in Yi qualifies as the first metal layer, and any metal layer **over** the first metal layer qualifies as the second metal layer in claim 17. Ergo that **151** (Cr) is formed over the metallization of the semiconductor chip reads on the first metal layer of instant claim 17. Similarly, that **155** (Cu) is above and directly contacts layer **151** more than reads on the second metal layer of instant claim 17. For that matter, even layer **51** could be taken to be the “metallization.”

The disagreement is secondly based upon Appellant's misinterpretation of Yi as applied to instant claim 17. Appellant is of the mistaken notion that the nominal labels of “first,” “second,” “third,” and “fourth” metal layers in Yi must be taken as literal equivalents of those “first,” “second,” “third,” and “fourth” metal layers of instant claim 17. There is no legal or factual requirement that the Yi language match those of claim 17. Terms like “first,” “second,” etcetera, do not have some intrinsic meaning that necessarily equates them. In other words, all “firsts,” “seconds,” etcetera, are not the same in all publications, and there is no reason to assume such correlation exists. And again, nothing in claim 17 even requires the “first,” “second,” “third,” and “fourth” metal layers to be different metals and only appears to require direct contact between the second, third, and fourth metal layers, which Yi shows.

Assuming, *arguendo*, that claim 17 were so limited to sequential stacking and direct contact of the first, second, third, and fourth metal layers in a stack --which Examiner maintains is not required in claim 17-- Yi still discloses these features. The phased metal layer **53** of Yi (Fig. 9) clearly shows first, third, fifth, etc. metal layers (each designated as **151**) to be made of the same metal and second, fourth, sixth, etc. metal layers (each designated as **155**) to be made of the same metal. The order and layer contact is as instantly claimed. Although each layer (either **151** or **155**) is shown to be composed of laminates, the laminates only determine the thickness of the layer (either **151** or **155**) and are accordingly each only a **single** layer of metal **varying in thickness**, as Yi states at col. 4, lines 37-42,

“The chrome layers **151** get thinner from the chrome layer **51** toward the copper layer **55**, while the copper layers **155** get thicker from the chrome layer **51** toward the copper layer **55**.”

Given that the individual laminates within a given layer (either **151** or **155**) are not shown to change in thickness, the only manner to interpret the “varying thickness” in Yi is that the laminates makeup a single layer. Moreover, Yi equates each multi-layer thin film as a single layer, stating at col. 5, lines 39-40,

“The chrome and copper layers **151**, **155** are formed in the structure of the same, thin **multi-layers**.” (Emphasis added.)

So Yi teaches that the laminates form a **single** metal layer **varying in overall thickness** based upon the number of laminates in the layer (either **151** or **155**). For this reason, it is respectfully submitted that Yi **does** teach that the third metal layer is in direct contact with the second metal layer and that the fourth metal layer is in direct contact with the third, the third layer is in direct contact with the second layer, the second layer is in direct contact with the first layer, in the phased metal layer. Additionally, metal layer **51** is the same as **151** (e.g. Cr); therefore, although

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labeled differently, chromium is chromium is chromium; therefore, the combination of **51** and the laminated of **151** is still a single chromium layer of predetermined thickness and can therefore be interpreted as a "first metal layer." Note again that none of this manner of interpretation of the Yi phased metal layer is necessary for reading on the order of the first, second, third, and fourth metal layers to read on that order claimed in instant claim 17, because, again, there is no requirement for the first, second, third, and fourth metal layers to differ in composition nor any reason that the **words** first, second, third, and fourth correlate in Yi to claim 17.

Appellant continues, in the last paragraph on p. 11 of the Brief, in this general regard,

"The Examiner incorrectly construed Yi's fourth metal layer 155 (Cu) to be above and on Yi's third metal layer 55 (Cu), where it was asserted Yi's fourth metal layer 155 (Cu) was substantially the same metal as Yi's second metal layer 151 (Cr). Appellant respectfully requests that the Board overturn the Examiner's rejection."

Examiner respectfully but vigorously disagrees. Examiner has no idea from where Appellant conjured that this was Examiner's interpretation of the Yi phased metal layer. Nothing in any Office action suggests that Examiner invoked layer **55** as part of the phased metal layer. Again, Appellant is of the mistaken notion that the nominal labels of "first," "second," "third," and "fourth" metal layers in Yi must be taken to be literal equivalents of those "first," "second," "third," and "fourth" metal layers of instant claim 17. As noted above, nothing in claim 17 requires (1) the first, second, third, and fourth metal layers to be different, or (2) layer **51** of Yi to be interpreted as the first metal layer in the context of instant claim 17. Accordingly, Examiner respectfully submits that the argument is without merit.

At the beginning of p. 12, Appellant argues, "the motivation to combine Yi with Agarwala, in view of what they actually teach, comes only from Appellant's disclosure." Examiner disagrees. As stated in the rejection of the claims, above,

"It would have been obvious for one of ordinary skill in the art, at the time of the invention, to form the phased metal layer of **Agarwala** using the method of **Yi** wherein the metal composition alternates between the different metals, in order to achieve the benefits indicated in **Yi**, such as achieving the desired thickness of the metal layers (col. 2, lines 59-63); and speeding up the process and reducing the cost of making the metal layers (col. 2, lines 64-67)."

This could hardly be construed as coming from Appellant's specification, as the suggestion to combine is directly extracted from the Yi reference. Accordingly, yet another of Appellant's assertions ignores the facts of record.

The errors in the remainder of Appellant's arguments on pages 12 through 14 with regard to the rejection of the claims over Agarwala in view of Yi have been amply addressed in the rejection of the claims and the arguments set forth above. Examiner respectfully submits that Appellant continues to misinterpret Yi.

Appellant offers no additional argument regarding the separate ground of rejection over Agarwala in view of Yi and further in view of the Microelectronics Packaging Handbook. Rather Appellant's arguments rely on a perceived deficiency in the combination of Agarwala and Yi. For the reasons indicated above, Examiner respectfully submits that the references themselves make clear that no such deficiency exist.

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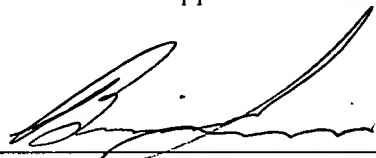
For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

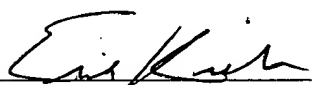

Erik Kielin, Ph.D.

14 July 2005

Conferees at the Appeal Conference held on 14 July 2005:


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